# UNIV-1100 — First Year Seminar: Scientific Computing Learning Community

Instructor: A. J. Meir
Peer Instructor: Lauren E. Gaines

Auburn University

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# Computer Performance

- Speed
  - Clock speed - MHz or GHz (megahertz or gigahertz, $10^6$, or $10^9$ HZ, Hertz, cycles per second)
  - Computing speed - MFlops, GFlops, TeraFlops, or PetaFlops ($10^6, 10^9, 10^{12}$, or $10^{15}$ floating point operations per second)
  - Communication bandwidth - Bus, switch, or interconnect bandwidth MB/s or GB/s (megabytes or gigabytes per second, $10^6$ or $10^9$ bytes per second)
- Size
  - Number of processors or cores (processing units)
  - Cache size
  - Memory size
  - Disk size
    - MB, GB, or TB (megabytes, gigabytes, or terabytes, $10^6, 10^9$, or $10^{12}$ bytes)

# History and Future of Computing

My personal experience...

Then (1990):

One 20MHz processor, 8MB memory, two 104MB disk drives, and a 3.5" 1.44MB floppy disk drive.

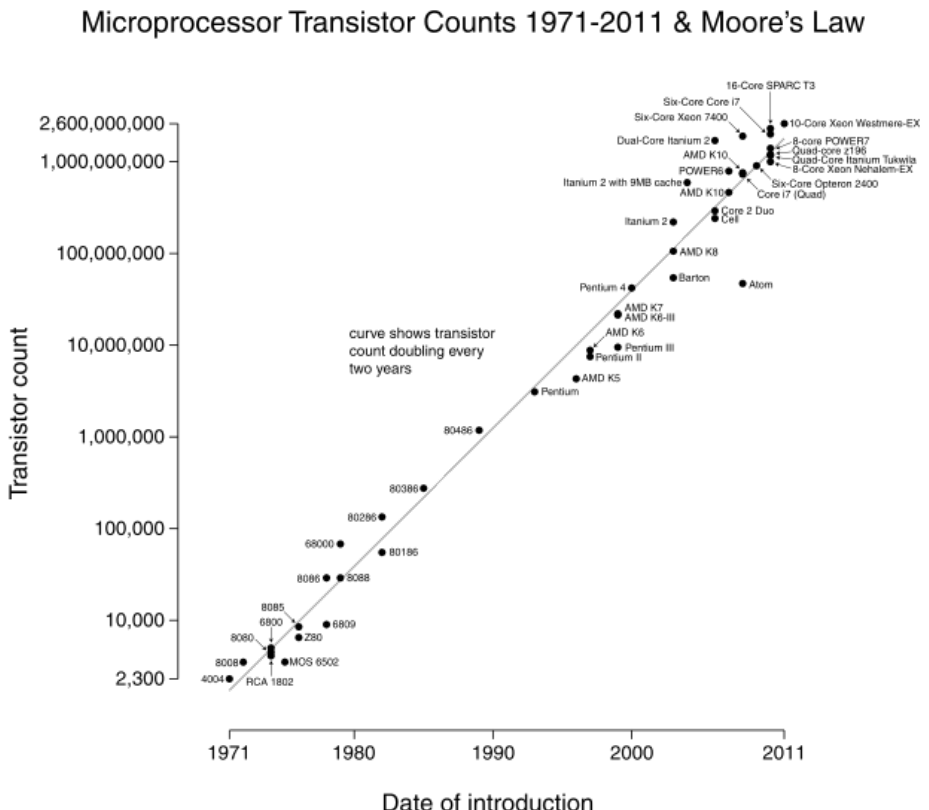
Now (2010):

Two 2.93GHz 6-core processors, 16GB memory, a 1TB disk drive, and a double layer DVD drive (approx. 8.5GB).

# Moore's Law

Named after Intel co-founder Gordon E. Moore states that the number of transistors on a given chip can be doubled every two years.

This has been the guiding principle of progress in electronics and computing since Moore first formulated the famous dictum in 1965.

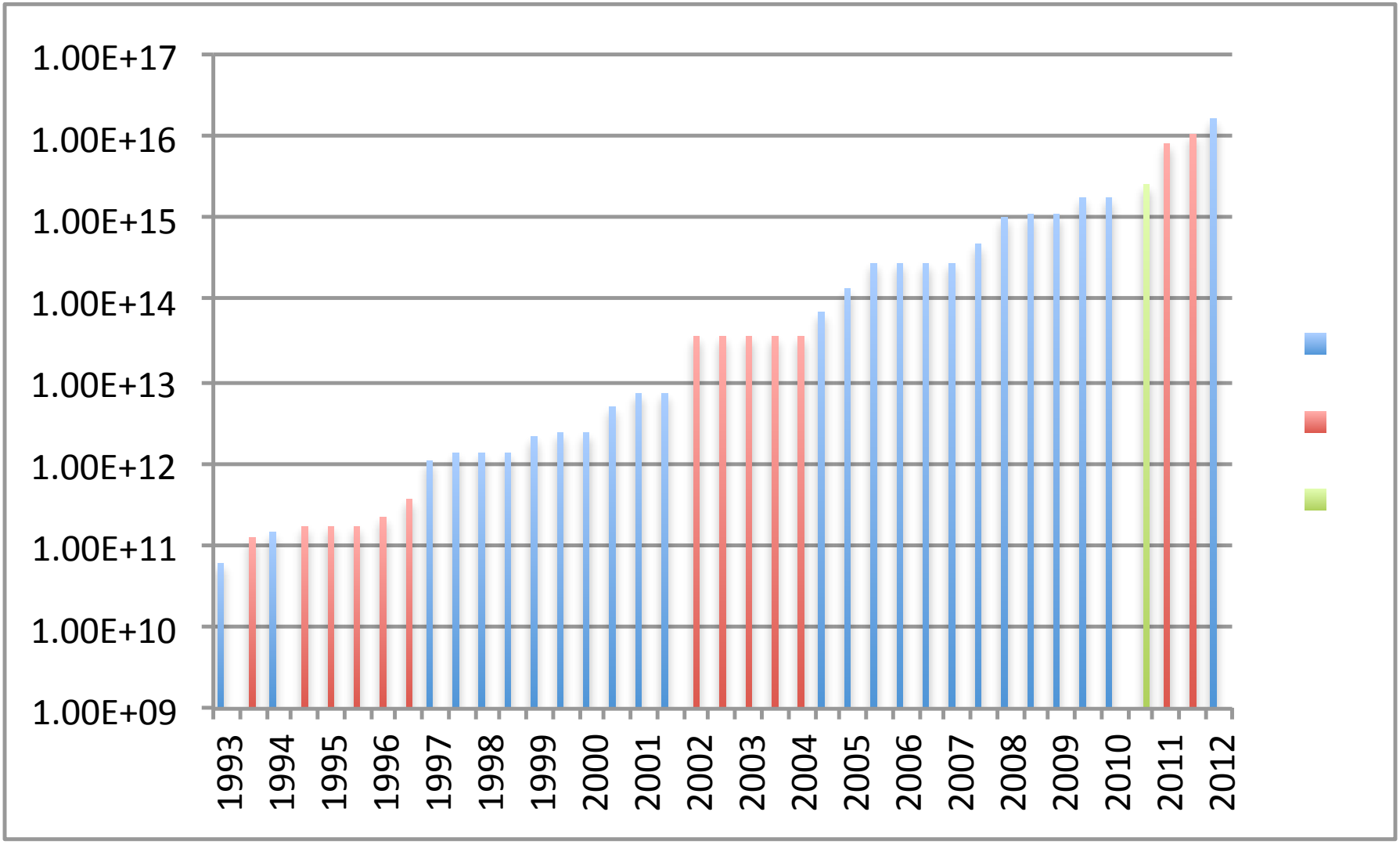


# Top 500

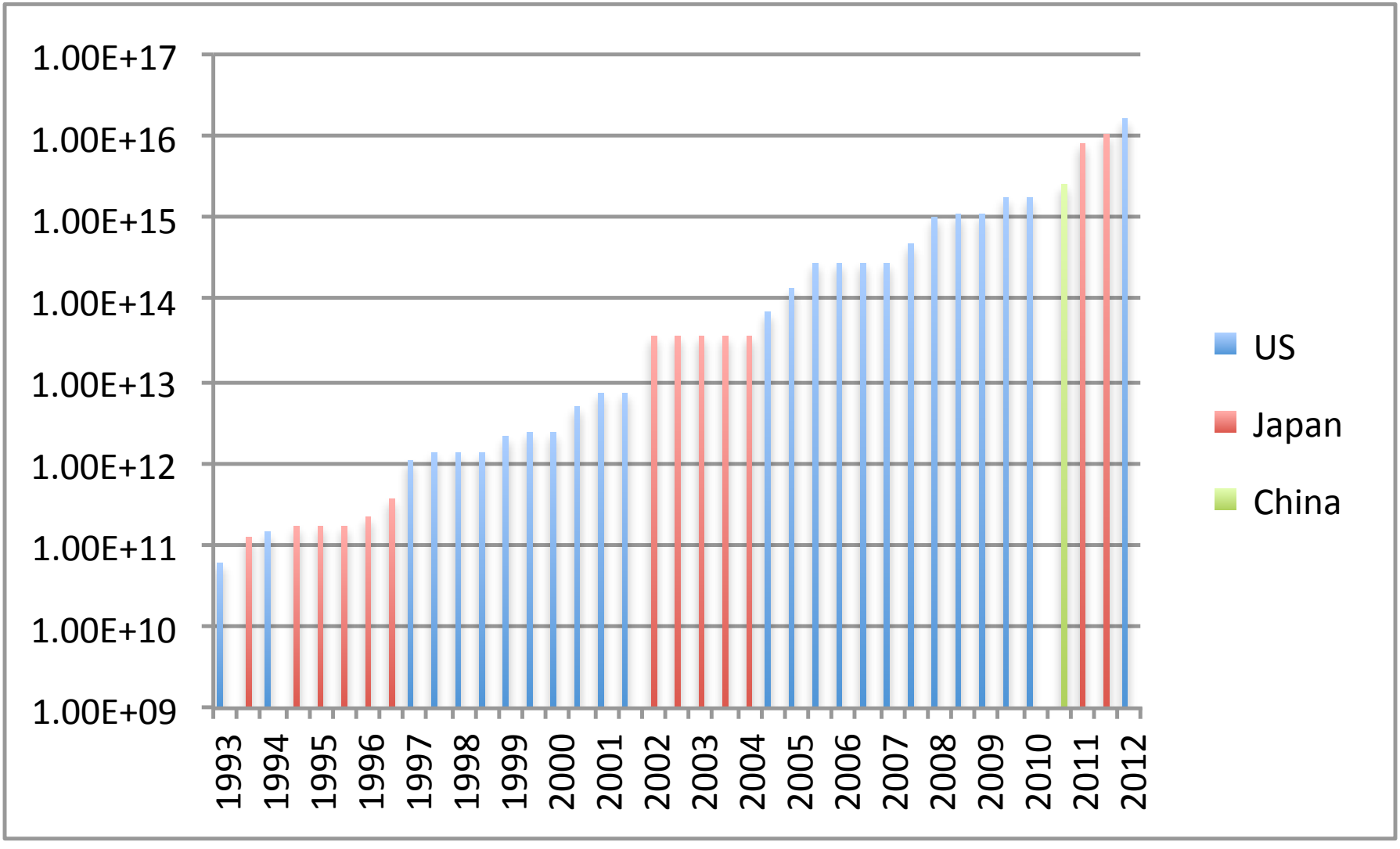

www.top500.org

The Top500 report lists the 500 fastest computer system being used today. In 1993 the collection was started and has been updated every 6 months since then. The best Linpack benchmark performance achieved is used as a performance measure in ranking the computers.

# Supercomputer Performance



# Supercomputer Performance



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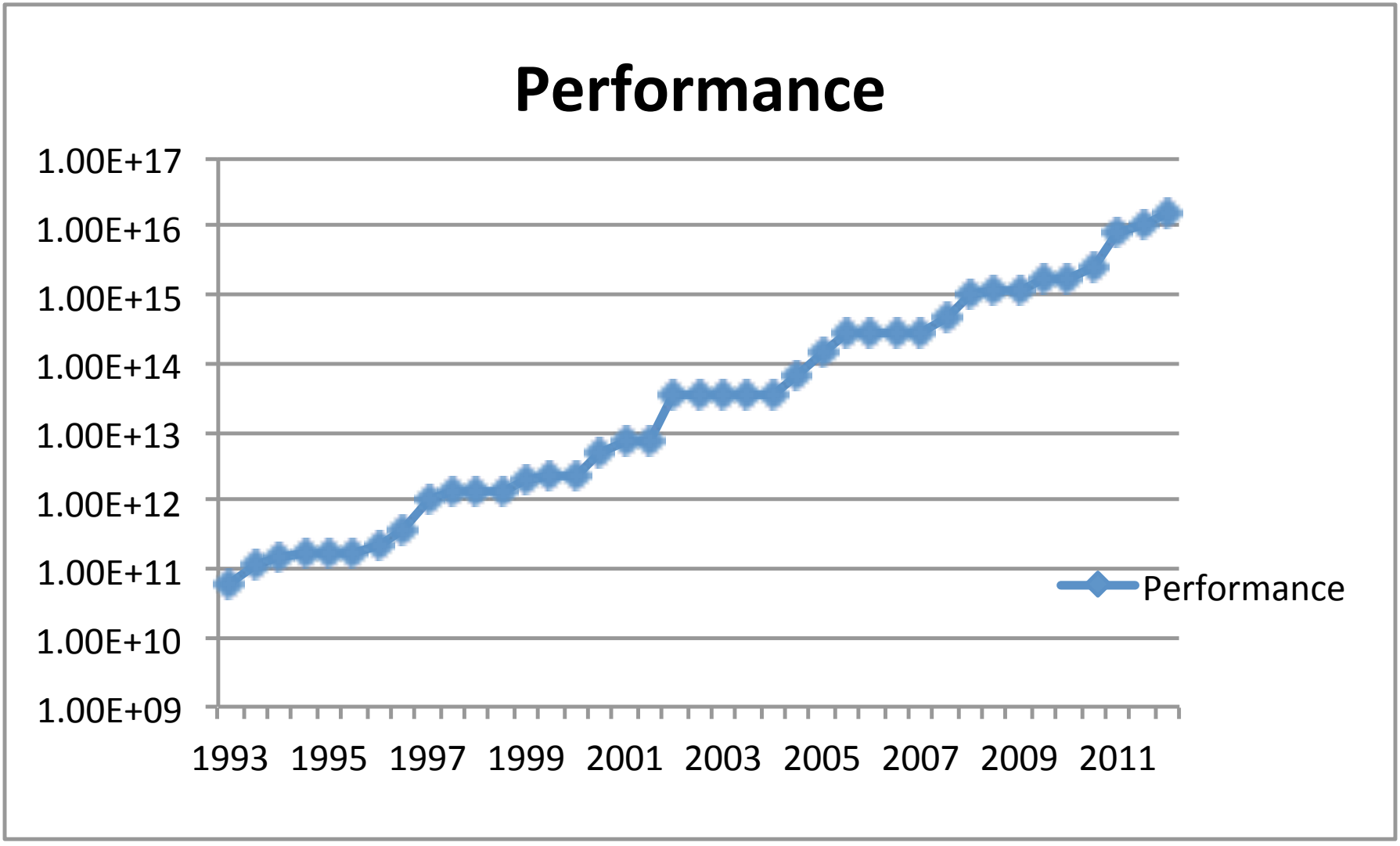
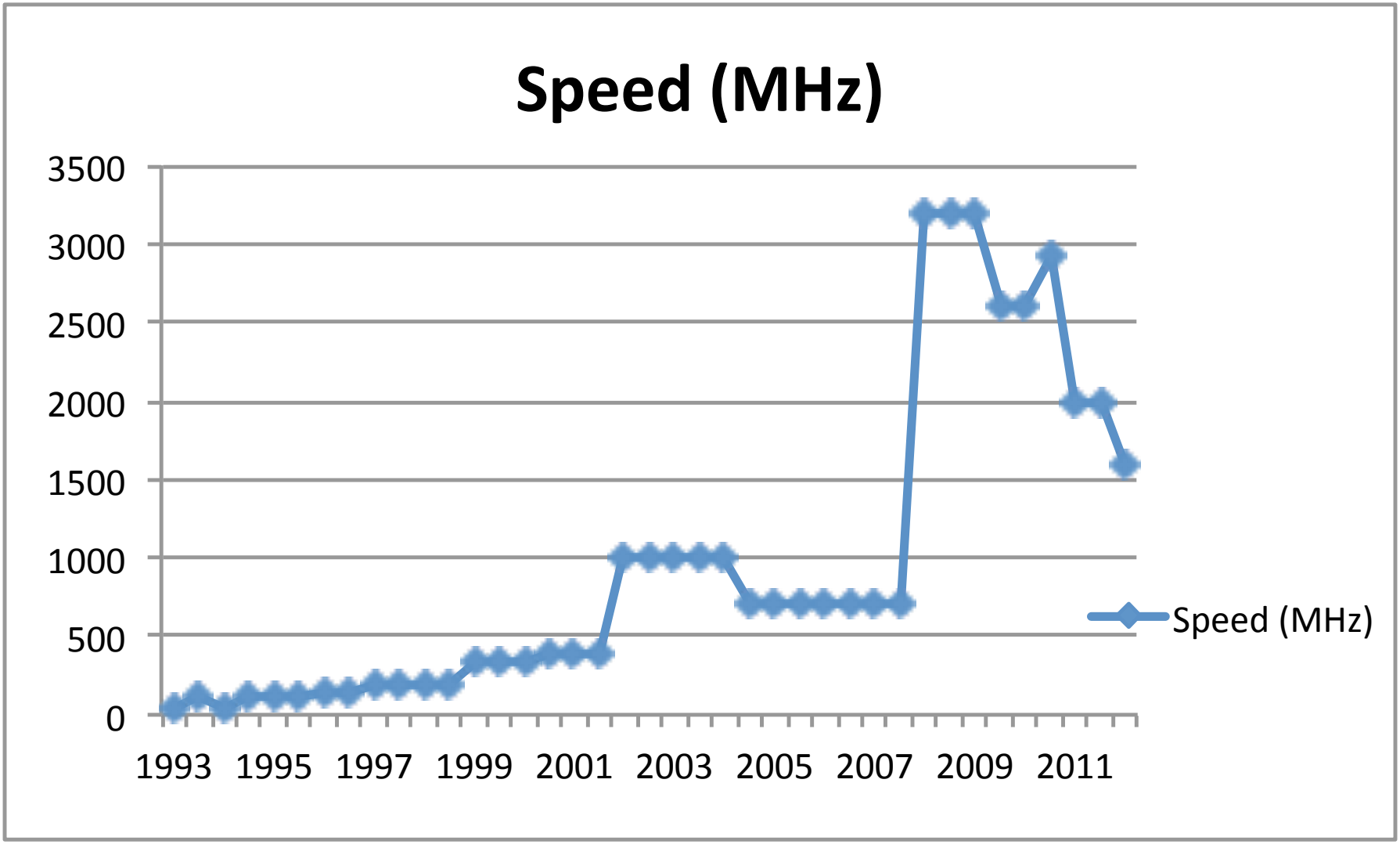


# Supercomputer Characteristics



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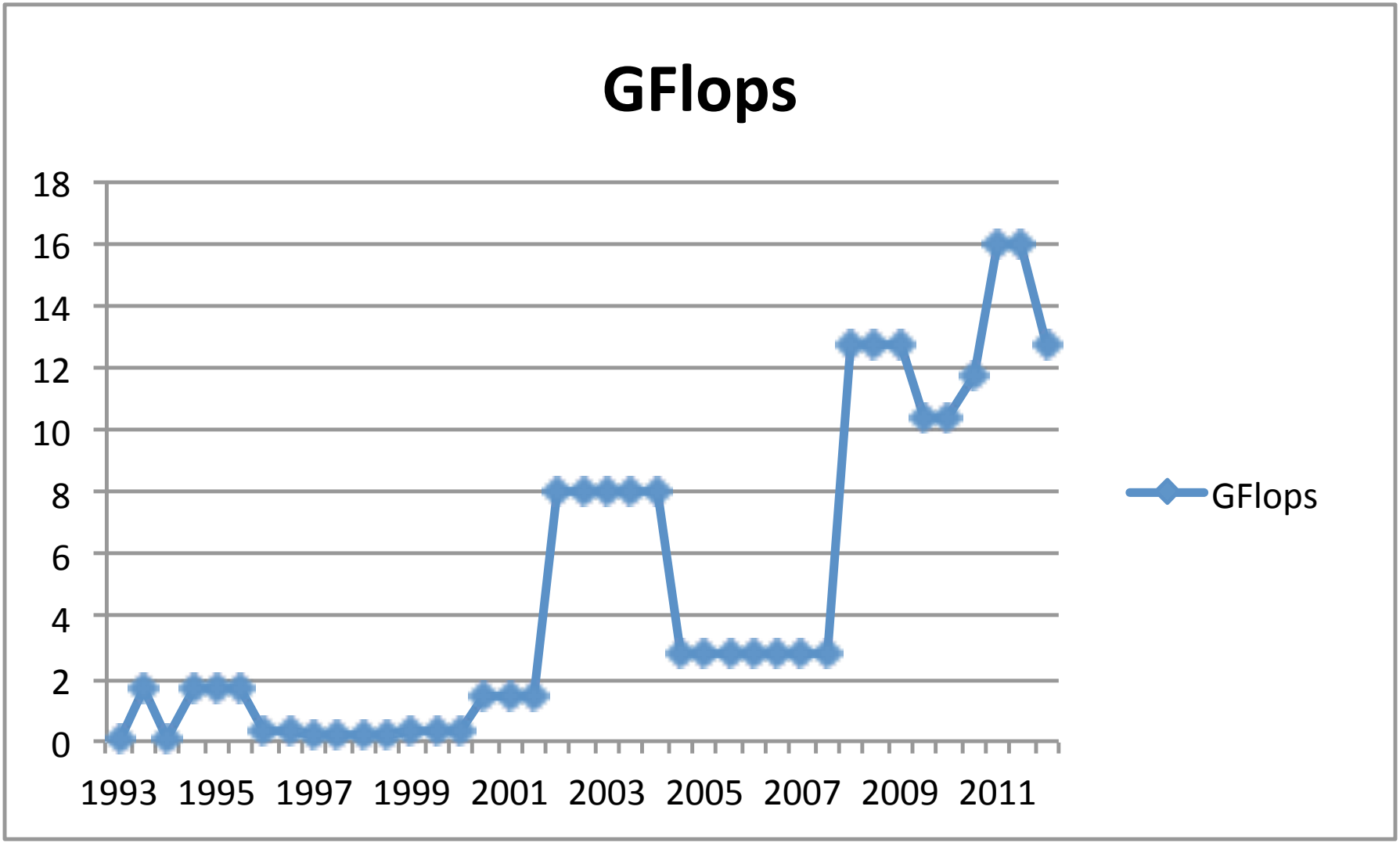

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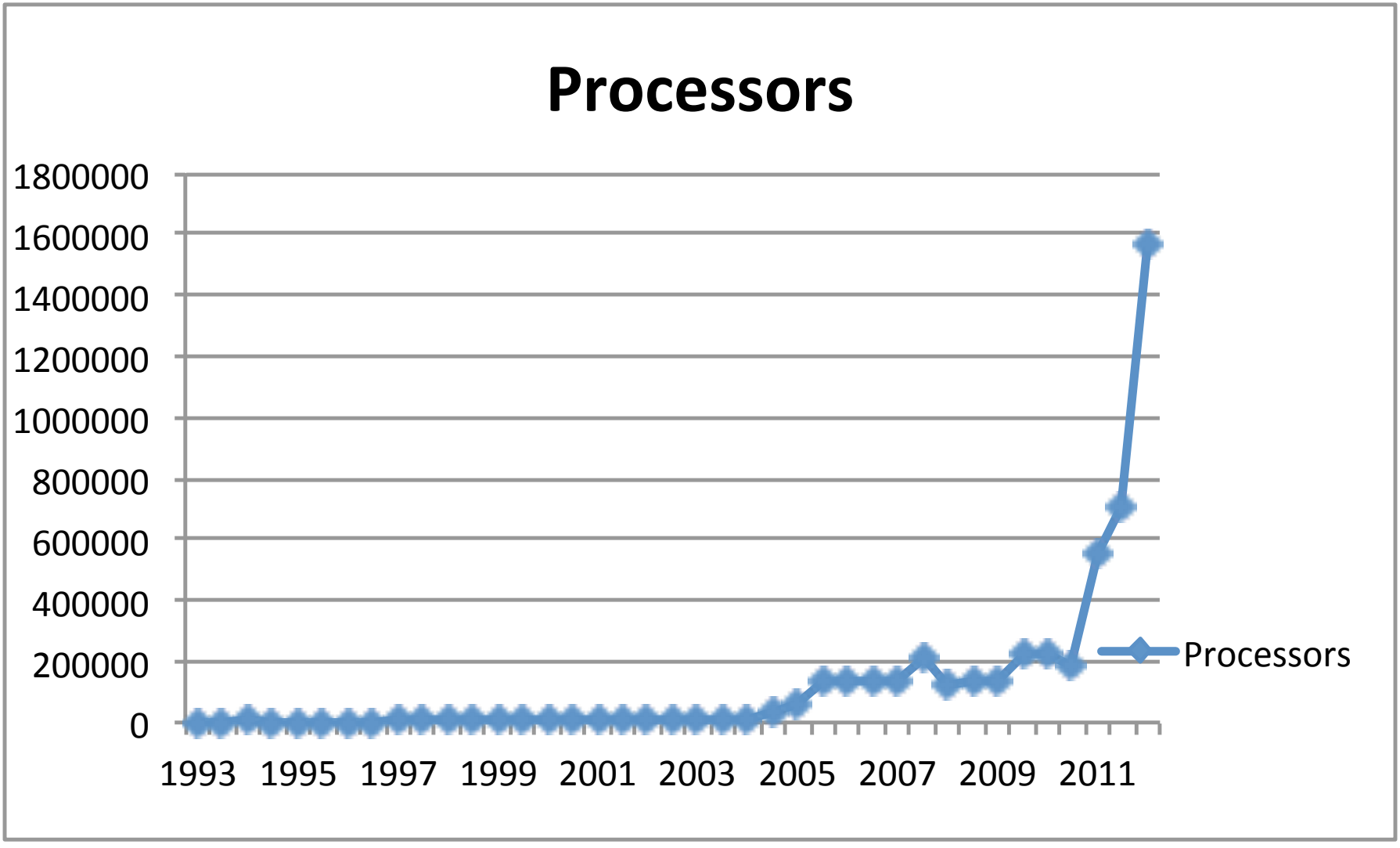

# System X

MATH MATTERS

## Apply It.

### The Math behind SUPERCOMPUTING…

**What is supercomputing?**

Supercomputers perform long complicated programs, often based on mathematical models with many variables.

**Uses and Applications:**

Supercomputing can produce answers to the "what-ifs" of our world. For example, what would happen if an asteroid struck the earth at a certain angle in a certain place, etc.? We can use supercomputers to figure out things like the long-term patterns of diseases and to model bone structure and its response to a number of variables.

**How it works:**

Supercomputers are, for the most part, just what we call them—SUPER computers. These machines are capable of handling many variables and graphically representing the outcomes.

**Interesting Fact:**

Students at Virginia Tech constructed a supercomputer using 1100 Power Mac G5s. For something that usually costs $100-250 million, and managed to create a viable and efficient example for about $7 million… and it works!

Society for Industrial and Applied Mathematics
www.siam.org
http://www.siam.org/careers/matters.php

siam.

# System X

Started as an 1100 Dual 2.0 GHz Apple G5/Mellanox Infiniband 4X/Cisco GigE and upgraded in 2004 to an 1100 Dual 2.3 GHz Apple XServe/Mellanox Infiniband 4X/Cisco GigE

http://www.arc.vt.edu/arc/SystemX/index.php

| Year | Rank |
|---|---|
| 11/2003 | 3 |
| 11/2004 | 7 |
| 06/2005 | 14 |
| 11/2005 | 20 |
| 06/2006 | 28 |
| 11/2006 | 47 |
| 06/2007 | 71 |
| 11/2007 | 109 |
| 06/2008 | 282 |

# Academic Integrity

Academic integrity is of utmost importance to the mission of the university (create, discover, and disseminate new knowledge and information).

# Reproducibility and Replicability

- Replicability - Duplicate or recreate the experimental results (without any changes to the experiment).
- Reproducibility - Reproducibility of experimental results is a hallmark of science. Reproduce the results by (various) experiments that may differ from the original experiment.

# Academic Integrity

Students should be aware of what constitutes misconduct and violation of the Academic Honesty Code

- Plagiarism
- Self-plagiarism
- Cheating

# Academic Honesty

Violations of the Academic Honesty Code carry severe penalties

Auburn University Academic policies are available at
www.auburn.edu/academicpolicy

The Auburn University Academic Honesty Code is available at
https://sites.auburn.edu/admin/universitypolicies/Policies/AcademicHonestyCode.pdf

**Don't do it!**

# Auburn University Bulletin

The Auburn University Bulletin contains

- General information
- Academic policy and rules and regulations
- School and college curricula
- Courses of instruction
- List of faculty
- Other stuff

# Auburn University Bulletin - Example

- The Auburn University Bulletin
  www.auburn.edu/bulletin
- Curricula, e.g. COSAM
  http://www.auburn.edu/student_info/bulletin/science_math.pdf
- Courses
  http://www.auburn.edu/student_info/bulletin/courses.pdf
- Faculty
  http://www.auburn.edu/student_info/bulletin/faculty.pdf